

ASTRONOMIA CRISTALLINA.

OR,

A New and Clear Way

To *know* and *perceive* all the
MOTIONS of the HEAVENS;
AND ALSO THE
MOTION of the EARTH

Plainly, as through a *Crystal-Glass*.

Far more easie and perspicuous than any before
extant.

Whereunto is now added a Postscript by way of Dialogue, between the Author and two grand Objectors; wherein all Objections are fully answered, and the Objectors clearly confuted.

Composed according to the best Observations,
and most rational *Grounds* of ART.

By J. H. a Lover of Truth, and *Mathematical* Demonstrations.

The Second Edition with Additions.

Psal. XIX. 1.

The Heavens declare the Glory of God, and the Firmament sheweth his handy-work.

LONDON,

Printed for the Author; and are to be sold in *Cornhil*,
by N. Brooke at the *Angel*, and J. Hancock at the
three *Bibles* at *Popes-head Alley* end, 1676.



L I C E N S E D

According to Order.

July 5.
1670.





To the READERS.

Courteous Readers,

I Having observed the many Contests and Contradictions that have been among Authors, both Ancient and Modern, concerning the Heavenly Motions, some declaring, that the Earth was the Center, and that the whole Frame of the Heavens did run whirling about it in Twenty four hours: Others reproving of this, and saying, that the Sun was the Center, and that the Earth did run whirling about the Sun: Both which in my judgment, seemed very absurd; I therefore took a diligent view of the several Systems, and finding as great absurdities in the latter as in the former, or rather more: I considered how the Appearances might be solv'd another way, without either the Frame of the Heavens whirling round about the Earth, or the Earth whirling

To the Readers.

*ling round about the Sun; but by as much
quietness and stillness of both the Heavens
and the Earth as can be imagined: The
Eternal Creator of all these things, having
put this knowledge into my Mind, I thought
it my duty not to hide my Talent, but to
declare the same unto you my Countrey-men
and Fellow Creatures thoroughout the
World, that we may be the better able to
praise and glorifie God, the Eternal Maker,
and continual Preserver of all these things.
Which is the chiefest desire of*

Your Affectionate

&

Plain-dealing Friend,

J. H.

ASTRO-



ASTRONOMIA CRYSTALLINA:

OR,

A New and Clear way to know and perceive all the Motions of the Heavens, and also the Motion of the Earth plainly, as through a Crystal Glass.



IN the first place I shall begin with *Ptolomy*, and his Followers, who according to vulgar appearances, imagined the Earth to be as still as a Stock or Stone lying upon it, and the whole Frame of the Heavens to run whirling about it with a monstrous swift pace, as the holders of this Opinion tell us, that every Star in the *Aequator* goeth in one hour 4529538 German Miles; another of the same opinion, tells us, that the pulse of a well tempered Man doth beat 4000 times in an hour, and in the time of beating one pulse every Star in the *Aequator* must move 1132 German Miles. Another Author tells us, that according to common grounds, every Star in the *Aequator* must move 42398437½ Miles in an hour: Yet *Ptolomy*, in his System, did imagine other Heavens above and beyond the Starry Heaven, as a Crystalline Heaven, and a *Primum Mobile*, or first Mover, which were imagined to move far swifter than the Stars.

These monstrous incredible Stories have stumbled many, that otherwise would have been clearly of the same

judgment, because vulgar appearances do agree with the same Opinion, and also divers Texts of Scripture in the Bible do literally consent thereunto: But vulgar appearances are deceitful, and the Scriptures are not always to have a literal interpretation, as hath been proved very largely by several able Authors, in divers Books; whereof more hereafter, but I desire to be brief.

Although *Ptolomy* imagined all those great whirlings of the Heavens, yet he could not find, nor imagin by what means the Planets did move sometimes forwards, and sometimes backwards, and sometimes to stand still; but by imagining abundance of Epicycles, and such kind of ridiculous wheel-works in the Heavens: Whereas, in truth, there are no such things, but only every Planet hath his single Orb or line, to move in; yet they seem sometimes to go backwards, and sometimes to stand still; albeit they never at all go otherwise, but only forward; as shall be proved in due place and time.

This Opinion of *Ptolomy* held in the World a long time, through many Ages and Generations, and was upheld strictly by the Church of *Rome*; and, as Authors say, divers Men were sorely punished for questioning of it, because they did not believe as the Church believed: But at length *Copernicus* adventured to reprove this Opinion, declaring, that he had found out a way, how the Planets might move every one in a single Line round about the Sun, and although they go only forward, yet they might seem to us to go backward, and sometimes to stand still.

But this he could not conceive any way, but by imagining, that the Earth must be carried by a great whirling pace round about the Sun; and as Mr. *Wing* saith, in his Almanack 1669. *That the Earth is transferred in a day 86418 Miles, and in an hour 3600 Miles, and in a Minute 60 Miles about the Sun.*

And

And yet the *Copernicans* would perswade the World ; that we cannot perceive any Motion at all ; but this is as false and absurd , as the former Opinion of *Ptolomy*, and in some cases worse.

For first , With God all things are possible , though with Men impossible to know ; and therefore it is possible (though very unlikely) that the Heavens may run about the Earth in four and twenty hours , and the Earth to be still ; and if so , we may see the Pole Star in a constant place , and by it find and know , the certain Latitude both at Sea and Land , as we may , and do now.

But if the Earth were carried round about the Sun , at such a distance as some *Copernicans* have said, viz. 13755 Semidiameters of the Earth from the Sun, I say , that certainly if we , who dwell upon the Earth , should be carried with the Earth , sometimes 13755 Semidimeters Eastward , and another time 13755 Semidiameters Westward ; and sometimes to be elevated 13755 Semidiameters above the Sun , and Sometimes depressed 13755 Semidiameters below the Sun : I say , if it were possible , that we might not feel the motion (which is very unlikely) yet we must see our selves to be moved by the Pole Star , which without all question would not keep the same Elevation with the Earth , as now it constantly doth , if the Earth were so carried about , as is aforesaid by the *Copernicans* , but this is impossible : For then we must undoubtedly lose the use of the Pole Star for the Latitude , and then the Latitude would be as uncertain as the Longitude ; whereas now all Artists know , that a Man may , in all habitable parts of the World , know in what Latitude he is by a small Instrument , which a Man may carry in his Pocket ; and if he pass by Land 60 *English* Miles , or 20 *German* Miles , towards the North , he may find the Pole Star to be one degree higher ; and if he pass twice so far , he may

perceive the Pole Star to be two degrees higher ; and so every 60 *English* Miles, or every 20 *German* Miles, will alter a degree in Latitude more.

But if the Earth should be carried up and down, according to this *Copernican* Rate, it would be impossible to have any certainty of the Latitude.

But all that they have to say, in excuse of this great absurd Errour, is this, That no Man can know how far the Starry Heaven is from us. But this is but a poor shift : For many *Astronomers*, both ancient and modern Writers, have declared both the distance and bigness of the Fixed Stars, with whom, the *Copernicans* do comply sufficiently in all other things : But because this touches their Copy-hold, therefore they do not love to hear of it. They themselves will tell you how far it is to the Orb of every Planet, but of the distance of the Starry Heaven they will not declare, because it will utterly overthrow their former Works, some of the which are very large.

But if they will believe *Albategnius*, he tells them, that to the Starry Heaven from the Earth it is 19000 Semidiameters of the Earth.

And *Tycho Brahe*, a diligent Observator, as divers *Copernicans* report of him, he saith, that the distance is less than that of *Albategnius* by 5000 Semidiameters, that is to say 14000 Semidiameters of the Earth to the Starry Heaven ; the least of these distances is a very great space, for every single Semidiameter is 3436 Miles : But yet, although the *Copernicans* say, that these Men were skillful, and careful, and diligent Observators, yet in this Point they cannot please them. The truth is, nothing in this kind will please them, but either Infiniteness or Ignorance.

For seeing themselves to be run into such a great Errour, they seek to perswade us, that the distance of the Stars

Stars from the Earth is infinite, or else so great that no man can know; and so cast off the Opinions of those learned Men, which have declared their distance to be finite.

For indeed, if they should grant either of those distances before-mentioned to be true, or near the truth, they would be utterly cast concerning that Opinion of the Earths going round about the Sun, as may easily be demonstrated thus:

Take two sticks that are straight, each of them 14 Inches long, resembling 14000 Semidiameters, according to *Tycho*; or two sticks 19 Inches long, according to *Albategnius* his 19000 Semidiameters, and lay one of those couple of sticks upon a Table, and lay them so that they may touch together at the upper ends, and spread them at the lower ends until they be twice 13 Inches $\frac{3}{4}$ asunder at the bottom, that is according to the *Copernicans* supposed Orb of the Earth, twice 13755 Semidiameters, and then tell me whether that Angle at the top of the sticks will be perceptible or not; I suppose it will, for it will be very large; and therefore the *Copernicans* had need to plead for a large distance from us to the Stars.

Having now declared the absurd Errours of both the former Opinions, viz. *Ptolomy*, who deluded himself and the World with his Doctrine, thorough so many Ages and Generations before *Copernicus*; and *Copernicus*, who reproved him for a great Errour, and in the mean while did seek to delude the World with a greater Errour himself, as hath been before declared and sufficiently confuted:

Now, according to my promise, I intend to declare, how all the Appearances aforesaid may be (and without all question are) performed without the whirling of the whole Frame of the Heavens about the Earth in 24 hours,

hours, or the Earth whirling about the Sun, as aforefaid.

But before I come to that, I judge it needful to answer some seeming Objections that may be made from Scripture, concerning the Eftablifhing of the World, both the Earth and Heavens; as *Pfalms* 93. 1. *The World alfo is eftablifhed, that it cannot be moved.* & *Pfal.* 96. 10. *The World alfo fhall be eftablifhed, that it fhall not be moved.* This is meant of the whole Frame of the World, both Heavens and Earth, as is plain in *Proverbs* 3. 19. *The Lord by wifdom hath founded the Earth, by Underftanding hath he eftablifhed the Heavens.* Many more places might be cited, but in brief let thefe fuffice, becaufe they have been all fufficiently answered by other able Authors, and I defire to be brief; and therefore take notice, that the *Pfalmit* declareth, that the whole World is eftablifhed, both the Heavens and the Earth; and *Solomon* declareth more particularly, that the Earth is founded, and the Heavens are eftablifhed; then what can be more firmly declared. Yet we are not from hence to deny our own daily experience: for if we fhould conclude, that they, both Heavens and Earth, are fo fetled, as no Motion at all to be in either of them, we muft then deny that we fee Day and Night, Winter and Summer; and therefore although the Scripture doth declare unto us, that all the World both the Heavens and the Earth, be firmly fixed, founded, and eftablifhed, yet we muft take it in fuch fenfe as is agreeable to what we fee, and fo we may in this Cafe very well; for by thofe expreffions is plainly meant, that if all the Creatures in the World fhould joyn all their forces together, they could not alter the Work that God hath eftablifhed. But we cannot deny, but that there is a turning round of either the Heavens or the Earth every 24 hours, although both be firmly eftablifhed.

In brief, I take it to be thus, The Earth is eftablifhed

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in this manner, as a Work-man that intends to turn a Globe, or any such round thing in a Laeth, he must first fix it so firmly, that it may not move toward the right nor left hand, nor toward nor fromward, nor upward nor downward, so much as one hairs breadth (if he will make good work of it) and then a Man may well say, that it is firmly fixed; but yet there is liberty to turn round, or else he cannot make any work with it at all.

In the same manner we conceive the Earth to be fixed between the two immoveable Poles of the Heavens, that is, the North and South Poles, and so to turn about, according to the manner of an artificial Globe, in 24 hours gently and smoothly; which may very well be, and yet we that dwell upon the Earth not perceive it, especially in these Northern Parts wherein we live; for although at the *Aquator* the superficies of the Earth doth turn 900 Miles in an hour, yet in our Climate we turn not so swiftly by half; and this I suppose to be the cause why our Countrey-men, when they come first into those parts near the *Aquator*, at Sea, they are many of them troubled with a Disease called the *Calenture*, which makes them as it were Lunatick, and to think the Sea to be a green field, and if they be not looked to, they will run into the Sea. This I conceive is chiefly caused by the turning of the Earth more swiftly there than where they were born. But after they have been a while used to it, it is more natural to them, and then they are well again.

Another observable thing, in those Parts about the *Aquator*, Travellers report, that there is constantly an Easterly Wind, and the Sea constantly flowing Westward; which argues that the swiftness of the Earths Motion doth meet the Air, and so causeth a breezing Wind, and also doth cause the Water (it being liquid) to seem to run Westward, because it doth not keep pace with the Earth, which turneth Eastward. But

But in these Parts of the Earth, wherein we dwell, we see not the like, neither in the Air nor Water; yet it is observable in these Parts of the Earth, that where a River runneth Eastwardly, there the Tides flow farthest into the Land; and that is an Argument that the Earth doth turn Eastward.

Another Argument, for this quiet and convenient Motion of the Earth, may be drawn from the Waters, which, while they be within the Bowels of the Earth, they are as it were swung by the turning of the Earth up to the tops of the highest hills, and there, or near to the hill tops, they break out, and are the most fluent Springs of Water that are; and as soon as they are out of the Earth in the open Air, they presently run downwards towards the Earths Center with all possible speed: The Pearly drops of *May* dew which are swung up to the tops of the Grass do witness the same.

You may easily try an Experiment of this your selves: Take a quart por, or the like, and fill it half full of Water, and you may swing it about or over your head, or which way you will, and so long as you keep it swinging, there will not any drop of Water fall out at the mouth; but if there be but a pin-hole in the bottom, it will freely fly out there, upward as well as downward, and a gentle swinging in that manner will make a small wind, such as is reported to be about the *Equator*, as aforesaid.

Another Argument, for this quiet, easie, and natural Motion of the Earth, may be drawn from the inclination that all natural Creatures that live upon the Earth have unto sleep; which inclination, by experience, we know may be augmented by swinging and rocking of Children, or the like, and without question it is begun and maintained by the same, I mean, by the easie turning of the Earth.

Another Argument, for this quiet natural motion of the Earth,

Earth, may be taken from the Condition of Men that are not used to climbing high, who at first, if they ascend up an high Ladder, or to the top of an high House or Steeple, their heads will swim, but after by use it will grow more natural to them, and then they can endure it better: This, questionless, is also caused by the easie turning of the Earth.

Having thus shewed you, the necessariness, yea I may say the necessity of the Earths diurnal Motion; for by it we enjoy Day and Night, Sleep and Rest, Water in the highest Hills, and many other Blessings, which we might want if it were not so.

Now I come to shew you the annual Motion of the Sun, whereby we enjoy Summer and Winter, Light and Heat, and many other Blessings of that kind, and not only we that dwell upon this little Globe of Earth; but also all the Planets and Bodies which are within our Systeme, not as *Ptolomy* declared, by running and whirling round about the Earth every 24 hours, nor yet as *Copernicus* taught, that the Sun should stand still, and the Earth to run whirling about the Sun; but by a gentle sober Motion, the Sun goeth from one Sign to another, as from the first Degree of *Aries* unto *Taurus* in one Month, and thorough *Taurus* to *Gemini* in another Month, and thorough *Gemini* to *Cancer* in another month, and so in twelve Months he passeth thorough all the twelve Signs of the *Zodiack* quite round the Heavens and the Earth, and so in a Year he warmeth, enlightheth, and comforteth all.

The *Zodiack* which containeth the twelve Signs, is a great Circle that runneth oblique, or byas to the *Aequator*, and crosseth the *Aequator* in two places, viz. at *Aries* and *Libra*, in both which places it maketh equal Day and Night; and in going up from *Aries* to *Cancer*, it maketh our Summer and longest Days, in so much that it shineth quite over the top of the Earth near the North Pole, as at

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Greenland, and maketh all Day and no Night there until it is gone down to *Libra*, and then it beginneth to be dark under the North Pole and light under the South Pole, and when it is gone down to *Capricorn*, our Days, on this North side of the *Aequator*, will be at the shortest, and the Sun will shine quite beyond the Earth under the South Pole, and so make all Day and no Night there.

Having thus plainly shewed you the Motions of both the Earth and Sun, the Cause of day and Night, and Summer and winter; now I come to shew you how the five Stars, called Planets are moved; which sometimes seem to go backwards, although they go always forwards, every one in a single Orb or Line, going from West to East according to the succession of the Signs, that is from *Aries* to *Taurus*, and from *Taurus* to *Gemini*, &c. round about the Sun; and the three superiours *Mars*, *Jupiter* and *Saturn*, go round about the Earth also.

This is plainly demonstrated by the two Diagrams at the end of the Book: the Diagrams are one bigger, and the other lesser; the bigger being a whole Circumference, the lesser but little more than half a Circle.

The greater containing, first the Earth in the Center, next the Moon in her Orb, through which she goes round about the Earth every Month, but never about the Sun, but only about the Earth, like as the two inferiour Planets *Mercury* and *Venus* go only about the Sun, and not about the Earth, so the Moon goeth near to the Earth, and not at all about the Sun; the next Orb without that Orb of the Moon, is the Orb of the Sun, through which he passeth every Year; from the said Orb of the Sun are twelve Lines to the twelve Signs in the Starry Heaven, there is also another Right Line from *Gemini* to *Aquarius*, which Line is parallel to the Lines of *Cancer* and *Capricorn*, of which more hereafter.

The lesser Diagram, as aforesaid, is but little more than half a Circle, because if made in Paper (which is not so good as Glass or transparent Horn) it would hide too much of the bigger Diagram when it is laid upon it; and therefore you are to imagine the three Orbs of the three Superior Planets *Saturn*, *Jupiter* and *Mars* to be wholly round, as well as those two Orbs of the two Inferiour Planets *Mercury* and *Venus*; for, as you see in this lesser Diagram, they are all placed about the Sun, and the Sun is Center to all their Orbs, and they all keep their distance from the Sun, as you may see here in this lesser Diagram: First, *Mercury* is next to the Sun, and next without that *Venus*; and you are to observe, that these two Inferiour Planets never go round about the Earth, but as they go with the Sun; but the three Superior Planets *Mars*, *Jupiter* and *Saturn*, do go round both about the Sun and the Earth also, as you may easily perceive when the two Diagrams are fixed and laid one upon the other: In this lesser Diagram you have the Sun, Center to all those five Planets; *Mercury* you may see hath but a small Orb, and therefore he goeth the sooner through it, viz. in 88 days; the Orb of *Venus* as you may see is somewhat bigger, and therefore she is longer in going round thorough it, viz. 225 days; the Orb of *Mars* you may see is much greater than either of the former two, and therefore he is longer than either of them two in going round thorough his Circle, viz. 2 years; the Orb of *Jupiter* you see is greater than the Orb of *Mars*, and therefore he is longer before he can go round thorough it, viz. 12 years, and lastly the Orb of *Saturn* is bigger than any of the rest, and therefore he is longest of all in going round thorough his Circle, that is to say, 30 years.

You are also to observe, that in the lesser Diagram there is a Diameter Line which passeth from North to South, that

that is, from N to S; the which Line, in sliding the lesser Diagram upon the greater, is always to be kept parallel with the two parallel Lines in the greater Diagram afore-said, the one of them going from *Gemini* to *Aquarius*, and the other from *Cancer* to *Capricorn*.

The two Diagrams being thus made and fitted, the best way and means to slide the lesser upon the greater, as afore-said, is to draw a Thread thorough the two Centers, and thereby to give the Sun just so much length as that he may go round the Earth upon his own Orb described in the bigger Diagram, and then you may plainly see how the Sun doth go round the Earth once in every year, and carrieth with him the five Planets in their Orbs as in a Frame: (And much according to the same manner doth *Jupiter* carry with himself his four *Satellites* or little Stars, which move about him, and keep their several distances as the Planets do about the Sun.)

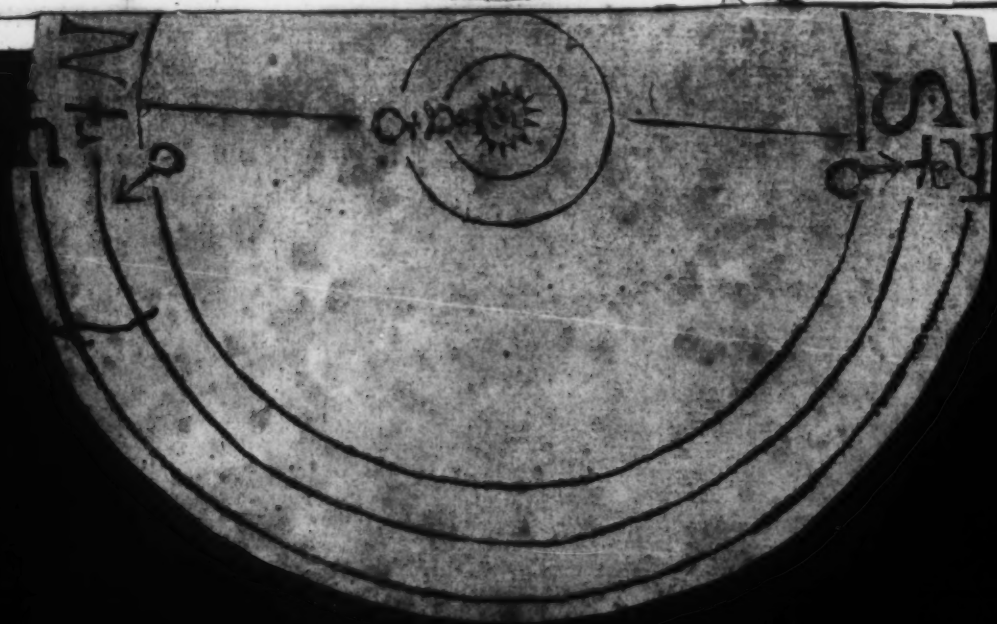
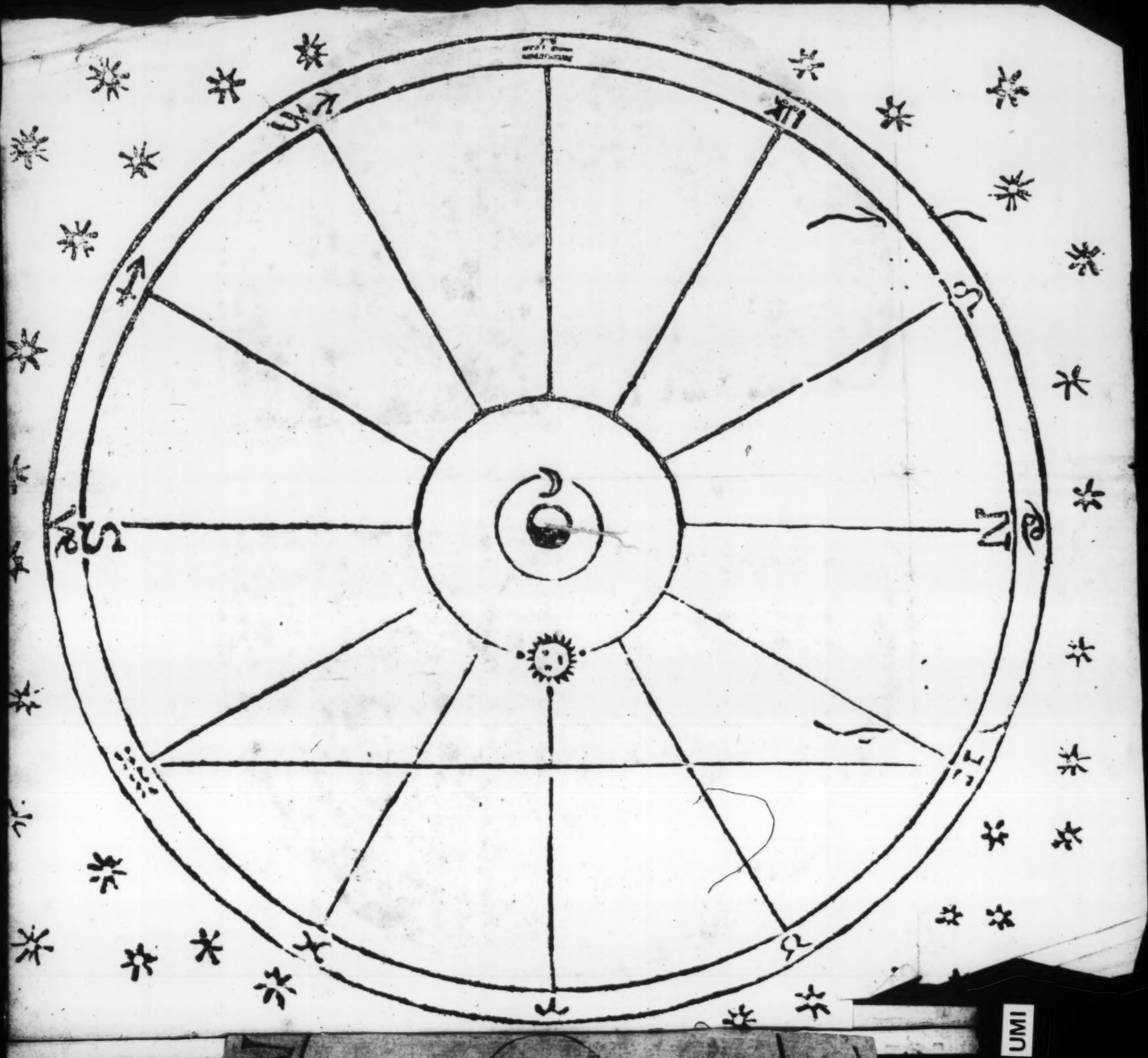
The lesser Diagram being so made and fixed upon the greater, first set the side that is streight parallel to the parallel Line *Gemini* and *Aquarius*, and then set the Sun upon his own Orb at the Line of *Aries*, then slide the lesser Diagram gently towards *Taurus* (still keeping the Lines parallel) and if a Planet be, as you may see, at N, that Planet so placed, will seem at the first moving of the Sun to be stationary, but before the Sun hath passed half way towards *Taurus*, you may plainly see the Planet in that place to go direct, that is, toward *Cancer*: But, in the meantime, a Planet at S will go retrograde, that is, backward from *Aquarius* towards *Capricorn*; and so a Planet at S will go Backward, and a Planet at N will go forward, until the Sun hath passed almost to *Libra*, but after the Sun hath passed *Libra*, you may soon see that the Planets will change their goings, and then the Planet at N will begin to go backward in appearance, and then the Planet at S will

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go forward, and so will continue until the Sun hath passed almost to *Aries* again: But you are to consider, that all this while the Planets go on by little and little in their own Orbs; for while the Sun moveth from *Aries* round about to *Aries* again, that is, in a year, *Mars* in that time will be moved in his Orb from N to S, for in two years he goeth round quite thorough his Orb; and *Jupiter* in the same space of time, will be moved a sixth part of the Semicircle from N towards S, for in twelve years he will go quite round; and *Saturn* will be moved in the like time, but a fifteenth part of his Semicircle from N towards S, because he will be thirty years in going round and thorough his Orb or Circle, and therefore he will be retrograde longest of all. You may also observe, that by the going of the Sun round about the Earth, and being always in the midst of the Orbs of the Planets, he swayeth the three Superiour Planets much nearer to the Earth at some times than at other times, and that is the cause why *Mars* (which is the nearest of the three) doth show so abundantly bigger at sometimes than at other times, for the Sun swayeth the Orb of *Mars* nearer to the Earth than the Orb of the Sun it self, as you may plainly see by the sliding of the Diagram: *Venus* and *Mercury* go direct when they are in the upper side of their Circles above the Sun, and retrograde when they are in the lower side of their Circles below the Sun. Thus have I briefly and plainly described unto you the ways and means, by which all the Heavenly Motions, in all probability, are performed, whereby we may see the great, excellent, and most unspeakable Power and Wisdom of God, the Eternal Maker, Ruler, and Preserver of all, who also hath given to Man, and to Man only among all his Creatures, Knowledge to behold and admire his great and wonderful Works, and to praise and glorifie his great and holy Name: To whom be ascribed all Praise, Honour, and Glory, thorough all Ages and Generations, World without End, *Amen*.

An Ecce to the DIAGRAMS.

BEhold and mind, how Sol doth pass
 About this Globe of Earth;
 And like a *Giant runs his race, *Psal. 19. 5.
 With Vigor, and with Mirth.
 The Planets all about him trace,
 Each in a several Ring:
 He in the midst of all doth march,
 Like unto a stately King.
 If he goes to the right or left,
 Their Orbs he so doth sway:
 As his Creator hath decreed,
 They all him do obey.
 Sometimes directly they do go,
 From Sign to Sign in order;
 Sometimes they seem to stand quite still,
 As if they'd go no further.
 Sometimes likewise they backward go,
 When Sol doth them oppose;
 Which made our Fathers wonder much,
 From whence those things arose.
 Thus may we see, God hath him made
 Guide of those wandering Stars,
 Concerning which, from Age to Age,
 Hath been such wondrous farrs.





THE POSTSCRIPT.

A Ptolemean Objector meeting the Author, and being strongly possess'd with vulgar Conceits, salueth him thus;

Objector. *Well met Sir, by Moon-shine; I am glad that I have met you at so fit a time; for I understand you are the Author of a little Book of Astronomy, call'd CRYSTALLINA: and I have divers things to object against it; and this clear night will, I hope, be a fit time for that purpose.*

Author. You are welcome by night or by day; object what you please, I am free to answer all your Objections: What is the first?

Obj. *In the first place, I wonder much that you should slight all the former Astronomers, both Ancient and Modern, and seem to have more skill than they; you being but a plain English man, and but a mean Scholar.*

Auth. That is a great mistake in you to think so; for I much honour the ancient Astronomers, and I own them to be our Schoolmasters; for if the *Arabians* or *Egyptians* had not found out the courses of the Planets, we in *England* might yet have been ignorant of them; because we dwell in a thick air, and they in a clear air, where
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they have little or no rain or clouds, but we have much of both; yet you may be pleased to let a plain *Englishman* give his Judgment of things in controversie; for the former *Astronomers* did contradict one another before I medled with them; and the same God which made them, made *Englishmen*, and for ought I know, gave as good judgment to them, as to the other; though *Englishmen* are apt to prize more highly that which cometh from far, than that which is bred at home.

Obj. I confess that is a practice too much used in England; but you seem not only to contradict the ancient *Astronomers*, but also to deny that which we see with our eyes every day; for we see that the Sun doth every morning rise in the East, and goeth Westward all day, and at night we lose the sight of him in the West; and that you deny, and say, that the Earth doth turn Eastward; and that the Sun and Moon also do go Eastward: I wonder how you can entertain such thoughts.

Auth. You need not wonder at that, if you will but grant that the Sun and Moon do go according to the succession of the Signs, that is to say, from *Aries* to *Taurus*, and from *Taurus* to *Gemini*, &c.

Obj. I will grant that, or else I should be contrary to all men.

Auth. Then I do not doubt but to bring you quickly to be of the same mind with my self: I will give you in a little Paper the Figure of the Constellation of *Aries*, which is the first Sign: It is chiefly known by six great Stars, four of them make a large square almost equally sided, and that which is in the North-west corner, with the other two great Stars, maketh a Triangle almost equally sided likewise: the Square signifieth the Body of the Ram, and the Triangle signifieth the Head of the Ram: There is also a little Star at the Letter A, which

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is said to be the first Star of *Aries*, because at that Star the Ancients began to reckon the Longitude of the Heavens. The next Sign is *Taurus*, and in it is the seven Stars called the *Pleiades*, and they are on the back of the Bull; and a little more Eastward is the Bulls eyes and face, called the *Hyades*: And the next Sign is *Gemini*, where you may see two great Stars, the one is called *Castor*, and the other is called *Pollux*; and they signifie the two heads of the two Twins; they are seemingly near three foot asunder. The next Sign Eastward, is *Cancer*, and so forward of the rest: But learn you first to know these three Signs well, and that will do what we have need of at this time: You may see the Moon is now Westward of *Aries*, and the next night but one she will be in *Aries*, and with the Stars signified in the Paper, and two nights after, she will be with the seven Stars; and two nights after that, she will be in *Gemini*, with *Castor* and *Pollux*; and so will go more and more Eastward, until she hath passed quite round to the same place again. Take the Paper home with you, and view the Stars well, and come again about this day seven-night, and let me know your mind then.

Obj. *I will observe what you have told me, and so I wish you a good night.*

Auth. A good night to you also; you are very welcome.

Thus they part, and the Objector cometh a week after.

Obj. *By your leave Sir, I am come again according to your appointment, and have brought a friend with me which is a Copernican.*

Auth. You are both welcome; but what say you now concerning our last Discourse?

Obj. *I did as you bade me, and found all things to agree right as you told me, and I have by your means learned to*

know readily all those Stars which you described unto me, and I found thereby plainly, that the Moon doth go from West to East, which I thought no man could ever have perswaded me to believe; but by your directions I see it so plain that I have nothing more to object against it; but I do really believe that you are in the right, and that the diurnal motion which causeth Day and Night, is most likely to be by the turning of the Earth; for I find plainly that the Moon and Sun do go through the Heavens the contrary way to that which I and many thousands did generally think; and therefore as I said before, I have not a word more to object against you; but my Friend saith, that he hath a little Book which was made by Mr. Shakerly, a Copernican, which he is confident will convince you.

Auth. Let your Friend come near and bring Mr. Shakerley's Book, and try whether he can convince me or not.

Objector 2^d. Sir, This little Book was written by a very able Astronomer, Mr. Shakerley by name, and he proves in this little Book that the Sun doth not move at all, but standeth still in the Center; and that the Earth is a Planet, and goeth about the Sun as the other Planets do; and that the Earth is of like Matter and Substance as the other Planets are.

Auth. I have read that Book of Mr Shakerley's, wherein he hath written so as you say; but you say that he hath proved that the Earth goeth about the Sun; but that I deny: Neither Mr Shakerley nor any man else never proved it. I can shew you his Systemie, and disprove that by his own Systemie: I confess he hath declared in very high Language for Copernicus, and hath run down Ptolomy and the wilful Peripateticks, as he calls them, sufficiently: And I hold well with him for the diurnal motion to be by the turning of the Earth; but I utterly deny, that

that the Earth can have any such annual motion as he imagines; for if the Earth should be moved sometimes above the Sun, and sometimes below the Sun, as he, and you *Copernicans* imagine, how should men at Sea, know in what Latitude they are? or how were it possible that the fixed Stars should keep the same Meridian-altitude with the Earth all the year, as we may see they constantly do? But the Meridian-altitude of the Sun altereth every day perceptibly, except only when he is near to the Solstices.

Obj. *The Stars are supposed to be so far off that a little space on the Earth, is not perceptible.*

Auth. You do well to put in the word [supposed] for such a distance as you *Copernicans* imagine, was never proved, nor never will be: yet Mr *Shakerley* in his 48th Page, saith, that the distance of the Stars is not so great, but that with a good Telescope they may be reached, and more may be seen thereby, than we can see with the bare eye. And I by my own observation have found that the Stars near to the North-Pole, may be seen to appear bigger, and their distance greater, with an ordinary Prospective-glass, than we can with the bare eye; as may be proved by the middle Horse in *Charles-Wain*, and the little Star that is by it, which some call the *Driver*; and furthermore, the Orb of the Earth which *Copernicans* imagine, is not a little space; for if the Earth pass up and down about the Sun, it must go about both the Orbs of *Mercury* and *Venus*, as well as about the Sun; and you may consider that can be no little space; and therefore you may be sure that the Pole-stars nor any other fixed Stars would appear at the Earth with the same constant elevation as now they do, let the distance be as great as you can possibly imagin: But you may take notice that this way which I do shew you, doth not require
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any such great distance as you would have; for whether the distance of the Stars be great or small, this Systeme will well agree with it; and that is one of the four chief reasons which makes me to cling so close to it, rather than to the *Copernican* way, or any other. I will shew you all my four chief reasons, and then you may judge of it your self.

1. The first is, because by this *Hypothesis*, or English Imagination, is taken off that violent, swift, rapid motion in the starry Heaven, and *primo mobili*, imagined by *Ptolemy* to pass about the Earth in 24 hours, which was according to his Calculation, 42398437 miles in one hour.

2. This takes off *Ptolemies* Epicycles and wheel-works, whereby he thought the Planets were carried retrograde; but this agrees with all the heavenly appearances much better, allowing only one single line to every one single Planet to move in, and no more.

3. This takes off that swift and unreasonable motion of the Earth, called the annual motion of the Earth about the Sun, imagined by *Copernicus*, to solve the retrogradation of the Planets, which motion is reckoned by him to be 3600 miles in one hour: but in this Hypothesis which I shew you, there is no need of any such swift motion as either of them aforesaid; the diurnal motion of the Earth is sufficient to solve all the appearances, and that is, but the fourth part of the supposed annual motion imagined by *Copernicus*, that is to say, but 900 miles in an hour at the *Æquator*, but scarce half so many in the more habitable parts of the Earth.

4. And fourthly, As I said before, it agrees with any distance of the Pole-stars or any other fixt star, whether it be great or small: so that the Latitude is as certain in this as in *Ptolemies* way, and much more certain than

can be possible in the *Copernican* way : Consider well these four Reasons aforesaid, and if you please to read the 20th page of *Mr Shakerleys* Book, you may find that he yieldeth to me as much as I desire; for he doth grant, that although the Sun be Center to the Planets, yet the Earth may be Center to the Sun : And he doth also acknowledge and plainly declare, *That as for the Celestial Appearances, they are represented by both in the same manner*; and I do really agree with him concerning all the heavenly appearances; but only the Latitude; but in that I cannot agree with him, because it is against reason and all Rules of Art, And although *Mr Shakerley* doth in his 21th page dislike *Tycho's* Systeme (which is the same that I follow in all things but one) and saith that it is cumbred with perplexity of motions and tortuous Lines, he doth mistake; for in this way which I shew you, you may plainly see, here is no such things as tortuous Lines; for I assign to every single Planet only one single line to move in, and no more : And although upon one single Paper *Tycho's* Systeme cannot be described so, but that the Orb of the Sun, and the Orb of *Mars* will cut one another, yet you may know and consider that the Hub or Center of any Wheel will never hit against the rim or circumference of the same Wheel, so long as the Wheel is whole; and so it is with the Sun and *Mars* : The Sun is in the Center, and *Mars* is in the circumference, and though the Sun come where *Mars* was or will be, yet they will never be in one and the same place at one and the same time. This doubt is clearly taken away by my two Paper Diagrams.

Obj. *You seem to plead that the Earth is a dark, dull Body, without light or motion; but Mr. Shakerley sheweth that in the Earth is as much light and activity of motion, as is in the Moon, or in one of the other Planets.*

Auth. I will not deny but that the Earth may give a reflecting light to the dark side of the Moon when she is near to the Change, as the Moon doth to the Earth, when she is near the Full; but that doth not at all prove that the Earth is moved out of the Center, and that is the only chief thing in difference between Mr *Shakerly* and me. In his 47th page, he seems highly to extol the situation of the Earth, because, as he saith, she is carried about among the Planets; as if moving about were most noble: But in his 17th page, he saith, that the Center is the most noble place, and therefore fittest for the Sun. Observe how he forgets himself. And also in his 52^d page, in his Verses there, he seems to blame the learned *Pelussian*, for giving the Sun no larger scope, whereas himself will allow the Sun no scope at all, but to be kept still in the Center; as he forgot himself in these, and other such like things, in that his little Book, so I suppose he forgot the matter of the Latitude, or else he would not have pleaded to have the Earth to be moved from between the two Poles. Let the distance of the stars be what it will, for although you *Copernicans* would make us believe that the Pole-stars are or may be many millions of Diameters of the Earth distant from the Earth, yet none of you all can prove the distance to be so much as one hundred, nor one score of Diameters; and therefore that Argument is worth nothing: for *may be's* prove nothing. Much more might be said, but this is sufficient to convince you of this Error.

Obj Do you count this an Error, which all the chief Scholars in the World do generally embrace for truth?

Auth. Scholars do not always embrace truth; if they did, from whence riseth so many errors among them? They generally embrace what they are taught, and what they read in Authors without much consideration either of Reason

Reason or Art, but rather because some notorious Outlandish man hath so declared: But I go not that way to work; and therefore if you will stay a little, I will draw out the *Copernican* system with the Stars distant from the Center so far as Mr. *Shakerly* hath done, and some lines Pointing from the Earth unto the Pole Stars, whereby you may see plainly this great *Copernican* Error. Here is the System, take it home with you, and make a hole at the Letter O, and hang it on the East or West Wall of your Chamber, so that the lines may Point North and South, and let the Letter A signifie *Aries*, where the Sun is in *March*; and let B signifie *Libra*, where the Sun is in *September*; and suppose your standing to be near the Equinoctial part of the Earth, where you may see both the Pole Stars, and consider how you must look down towards the North Pole, and down also toward the South Pole when you are at A, and up toward the North Pole, and up toward the South Pole, when you are at B, and when you have well considered of it, come to me again two or three days hence, and then tell me if you can, what probability or what possibility there is like to be for the Earth to go such a monstrous great Compass about the Sun as you suppose, and yet we which dwell upon the Earth not to perceive it.

When you have well considered, you will rather find the Center to be the most proper place for the Earth, where it may turn exactly between the two Poles according as I have declared, for then there will be no need of any such large distance as you plead for, any distance will serve; although the Earth do turn Diurnally, that will not at all alter the Elevation of the Stars, nor prejudice the Latitude, if the Earth be in the Center; but if the Sun should be in the Center and the Earth be moved as you say, then the Latitude would be altered every hour.

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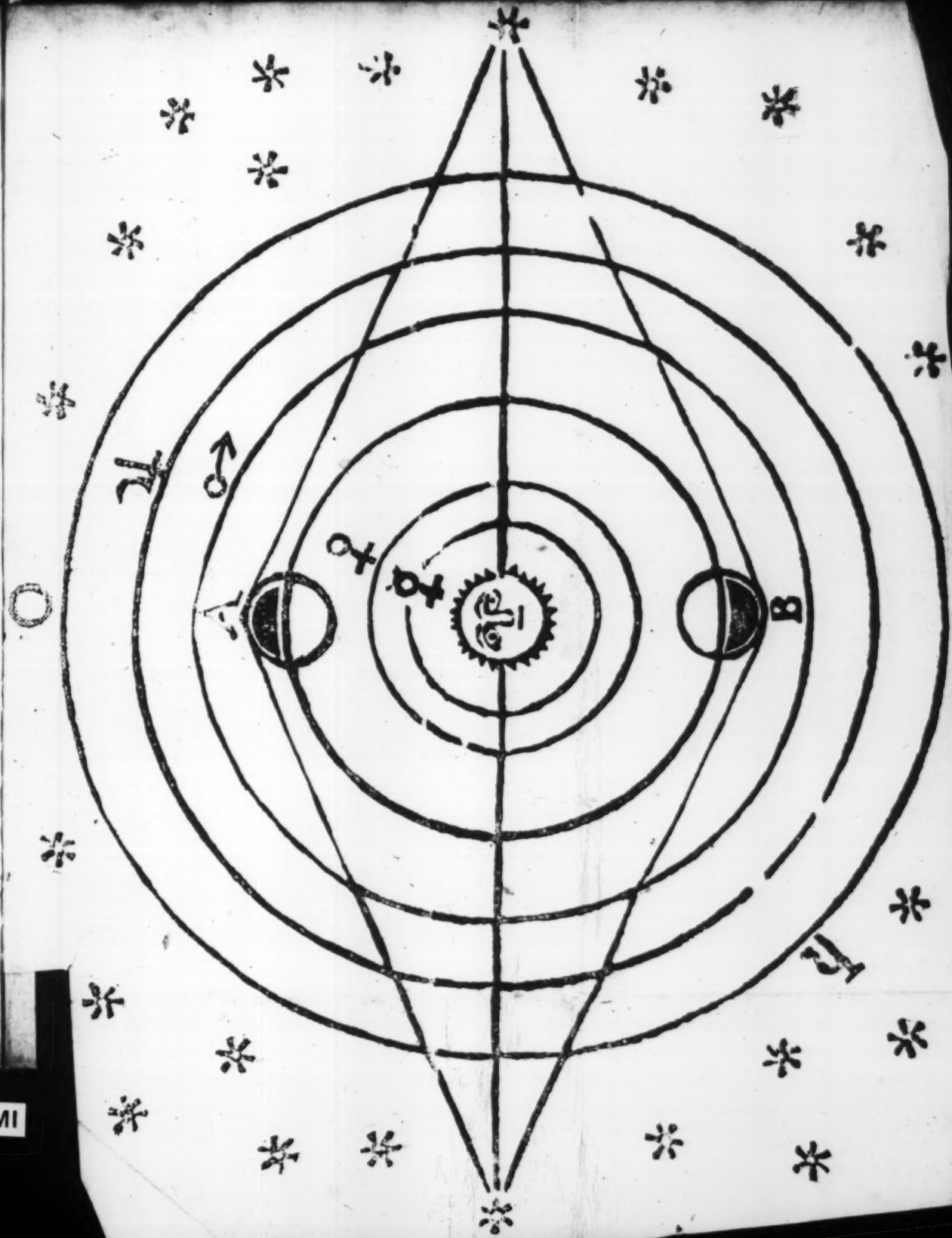
The second Objector goeth home and cometh again two days after, saying thus,

Obj. Well met sir once again, I am now come to confess my Error, and desire you to print your Book again with some Additions concerning our Discourse, and to put in this System thus lined, that so others may be convinced as well as my self, for I am now clearly of your Judgment, and I wonder now how so many great Scholars came to be so deluded by Copernicus; for I see there is neither probability nor scarce any possibility for that Opinion.

Auth. In regard that you and other Friends also do so lovingly desire it, I do intend to Print again; and to make also some Spherical Systems for the better explanation of the Matter, for those that shall desire them at reasonable rates, wherein shall be declared the single Monthly Motion of every single Planet, so plainly that any mean capacity may easily understand both when they go direct, and when they go retrograde. I will shew you another practice which you may perform in any round or square Room: imagin the Room to signifie the Heavens, the Sieling to signifie the North Hemisphere, and the Floor the South; in the middle of the Sieling fix a Hook or Staple, and thereon hang a Globe, or some round thing that may resemble the Earth, turning just in the middle of the Room; then draw or imagin four lines to go round the Walls of the Room: Let the first be just in the middle round about to signifie the Equator, and 23 degrees and a half above that; make or imagin another line, to signifie the Tropick of *Cancer*, and twenty three degrees and a half below the Equator, make another, to signifie the Tropick of *Capricorn*; then set ☉ in the North side of the upper line, and ♀ in the South side of the lower line; then set ♀ in the East side of the Equator, and ♀ in the West side of the same; then draw

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a slope line from ψ up to γ , and so up to \mathfrak{S} , and down from \mathfrak{S} to \mathfrak{A} , and so down to ψ again: This slope line is to signifie the Ecliptick which the Sun passeth through every year; and by setting a Light to signifie the Sun in any part of the slope line, and moving it by little and little, you may see how the days are lengthened and shortened very plainly, especially in the night if you have but one Candle in the Room.

F I N I S.

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*A short Touch in Verse, concerning the beginning
and proceedings of this my little Book of Astro-
nomy, called CRYSTALLINA.*

Vhen Pride in some *Copernicans*
Had rais'd a scornful Square,
They thought no Men in all the World
With them fit to compare.

When they their Neighbours did despise,
And did their Friends disdain;
Counting themselves the only wise,
Beyond all common strain.

When with insulting Language they
Did proudly brag and boast,
As if that they, and none but they,
Could view the Heavenly Host.

Then *Crystallina* was conceiv'd,
And quickly brought to Birth;
To shew the Motions in the Heavens,
And turning of the Earth.

And to convince *Copernicans*,
Whom Pride had puf't so high,
That in conceit, above all Men,
They to the Moon could fly.

And to confute their Errors great,
Which they made some believe:
Then *Crystallina* was put forth
The World to undeceive.

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When *CrySTALLINA* first went forth,
Copernicans did mutter:
 And some of them in Anger fierce
 Did make a grievous clutter.

Quoth *Zoilus* unto *Momus* then,
 It grieves me at the heart,
 To think how this small *English* Book
 Hath spoil'd our learned Art.

'Tis now in vain for us to say,
 The Earth goes round the Sun:
 And if we cannot hold out that,
 Our Doctrine's quite undone.

In former time I told Men so,
 And made them to admire:
 But if that I should say so now,
 They'l say I am a Lyar.

The case is now much altered,
 From what it was before;
 And by a simple *English* Piece,
 Which vexeth me the more.

If that some strange Outlandish-man,
 From *Egypt* or from *Greece*,
 Us to confute had hither brought
 Some strange Outlandish Piece;

Or if some leaped Doctor here,
 Well Skill'd in *Arabick*,
 In Volume large, and Learning deep,
 Had given us a check;

It had not vext me half so much,
 I better could have born it:
 But in plain *English* to be cross'd,
 Methinks I almost scorn it.

For this same *English Weaver's* Piece,
 It is as plain as Satin:
 There is not any Sentence in't,
 Of *Hebrew*, *Greek*, nor *Latin*.

And yet it hath so much prevail'd,
 Among the vulgar sort:
 That to confute *Copernicus*,
 They make it but a sport.

Quoth *Momus*, looking quite awry,
 It grieves me very much;
 For I do hear it is embrac'd,
 And lik'd well by the *Dutch*.

And if it doth take Rooting there,
 It soon will be in *France*:
 And so throughout all *Christendom*
 It quickly will advance.

[]
And if it comes to be embrac'd
In *Italy* and *Spain*,
Copernicus will then down, down,
And never rise again.

It hath prevailed very much,
Since it was first in Print:
And that makes many People say,
That sure there's something in't.

Quoth *Zoilus*, there is something in't;
You may be sure of that;
Or else, why should *Copernicans*
Be troubled so thereat?

Yea, there be four Reasons in it,
Not Raisins of the Sun:
But worle than *Malagaes* to us,
They have us so undone.

Yet they are counted very sweet,
To them that us oppose:
And them which do those Reasons like,
With us will never close.

But this doth grieve me most of all,
That stout *Copernicans*
Should be brought down, and made to stoop
By vulgar *English Hands*.